Are modern chemosynthesis-based communities a ‘glimpse of antiquity’? The changing fate of bivalves and brachiopods at ancient methane seeps as recorded in the Middle Palaeozoic of Morocco

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Despite much scientific effort aimed over the past three decades to better constrain the fossil record of chemosynthesis-based communities, our understanding of their early evolution remains fragmentary. Until recently, a dominant perception was that, unlike the Cenozoic, bivalve-dominated chemosynthetic ecosystems, the Palaeozoic to mid-Mesozoic methane seeps and hydrothermal vents were dominated by brachiopods. Similarly, the pattern of brachiopod vs. bivalve predominance at seeps and vents over the Phanerozoic was believed to have crudely followed that observed in normal-marine benthic shelly assemblages. Recent discoveries from the Middle Palaeozoic of Morocco have questioned this simple perception, documenting the presence of late Silurian and Middle Devonian seeps dominated by mass accumulations of large, semi-infaunal, modiomorphid bivalves (Hryniewicz et al., 2017; Jakubowicz et al., 2017). While representing a lineage unrelated to modern seep-obligate bivalve taxa, the mid-Palaeozoic seep bivalves developed a set of morphological adaptations strikingly similar to those of their modern ecological counterparts, and formed analogous, densely-packed, nearly monospecific assemblages, both suggesting their chemosymbiotic lifestyle. The new documentation of Palaeozoic establishment of the bivalve-dominated seep communities provides a fresh look at the concept of modern chemosynthetic ecosystems as a ‘glimpse of antiquity’, showing that although it is largely not true taxonomically, it clearly is in terms of recurring morphological themes. At the same time, this refined Palaeozoic record makes the factors responsible for the apparent scarcity of seep-related bivalves during the upper Devonian to early Mesozoic, a period of the remarkable success of brachiopod-dominated seep assemblages, ever more enigmatic.